MISCELLANEOUS NOTES ON AUSTRALIAN DIPTERA. XIII.*

THE ORIGIN OF THE VENA SPURIA.

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(Four Text-figures.)

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The *vena spuria* is a thickened convex line of the wing membrane between the radial and median fields, a line seen in most Syrphidae. This takes a course in its usual length that reaches the apex of the median cell, and sometimes it is formed like the veins but is brown and translucent instead of black and opaque.

It is very evident that this is a *vena obsoleta* that may be still traceable as a complete vein in Diptera, and the only position that seems feasible for its occurrence in the primordial condition is in the highly reticulate venation such as that seen in some Nemestrinidae. The following observations are put forward in support of this view.

The search for the origin of the *vena spuria* started when Tillyard (1926) was about to publish his book on the *Insects of Australia and New Zealand*. However, in those days, the primitive radial sector was judged to be dichotomously twice branched, and this formed the basis of the search. When Alexander (1927) showed that a divergence of the vein direction may form a pectinate radial sector, a new search proved equally unsuccessful.

Recently, when attempting to homologize the veins within the Bombyliidae, the opinion was formed that the radial field became reduced there in a way that was not identical with the reduction presumed to have taken place in the Tabanoidea. It was thought that the latter reduction arose from developments seen to have taken place in the Nematocera, but in view of this new evidence, this must now be regarded as an erroneous conception.

Arising from observations on the venation of the Bombyliidae, it was deduced that here the radial field originally had five radial branches traceable and separated. A plan to include a primitive radial sector was worked out on the reticulate venation of *Nemestrinus osiris* Wied. The result was astonishingly close to a complete explanation for several characters in the Brachycera venation, characters which remained anomalous under the Comstock-Needham and the Tillyard notations.

Hypothetical Venation.—Figure 1 gives the reticulate venation, and certain veins are indicated by dots to suggest those that would form the pectinate four-branched radial sector. From the base of this radial sector arises another, but convex, branch which is responsible for that strongly convex diagonal vein that traverses the wing in the Nemestrinidae. The course of this extra vein V-S corresponds to the track along which the convex *vena spuria* is seen to lie in the Syrphidae, as also that of the crease similarly placed in various families of the lower Brachycera.

The interpretation given here is not satisfactory in all details. Obviously a concave vein section of the upper median branch is eliminated from the Nemestrinidae and retained in the other families mentioned. On this account at least the hypothetical archaic venation cannot be truly represented by the Nemestrinidae beyond about the basal half of the wing, where the *vena spuria* is being traced in this paper, the remainder being left for future solution.

* Continued from these Proceedings, lxxi (1-2), 65-71.

The divergence from, and convergence towards, the vein Sc by the stem vein R is exhibited in Macquart's figure which is reproduced here. This is a feature seen in many wings of fossil Mecoptera and in those of primitive fossil orders, but it is very doubtful if the character can have been retained in any extant Diptera. None of Lichwardt's figures of venations of Nemestrinidae shows it, nor yet does Macquart show it other than in *Nemestrinus*.

The venation of the median field cannot be discussed until the primordial features are known, but in the figures given here it is shown that the veins M_3 and M_4 of taxonomy represent highly complex veins in the Nemestrinidae and Mydaidae.

Nemestrinidae.—Figure 2 gives the same reticulation, retaining those veins which suggest that the venation of the genus *Trichophthalma* may evolve from it. The vein marked R_5 is the vein with the notation M_1 in taxonomy, and its original alliance with the radial field is obscure, as a cross-vein marked *c* connects it to the median field. The letter *b* marks the position of another cross-vein found between fields in Diptera, and *a* is the normal radial-median cross-vein of taxonomy.

Cyrtidae.—In Part xii of this series, the venation of *Panops* was given in Figure 1 with the convexity and concavity of veins indicated. If, on that figure, a vertical line be drawn adjacent to the first furcation of the median vein, this line will cross eight veins, marked in Figure 1 as being C, Sc, R_1, R_s, V-S, M, Cu and A. These veins are alternately convex and concave on *Panops*, making R_s concave and V-S convex.

As this is found to be consistent in Diptera, then, in theory, where these two veins come together, the convex vein marks the retention of V-S, the concave vein being R_s. It is usual to find that R_s branches from R_1 and proceeds in continuity with a strong convex vein wherever there is no other sign of a *vena spuria*.

Mydaidae.—In the genus *Diochlistus* the radial veins do not follow quite the same route as those in *Trichophthalma*, and Figure 3 is based upon the same reticulation to show this. Apically, the four uppermost radial branches are joined by cross-veins and three of the branch veins do not reach the wing margin; this gives the appearance of four veins converging to a point. In addition, there is a stump-vein on R_3.

Asilidae.—The genus *Phellus* and some other genera have R_s and V-S adjacent to each other, lying almost contiguously. However, V-S is reduced to a prominent ridge, along which flecks of brown membrane may be more or less retained, till it joins R_s to continue in a strongly convex vein. Here the basal part of V-S evidently disappears in advanced genera.

Syrphidae.—In this family the *vena spuria* lies well apart from the radial field and, when complete, it arises from that basal cross-vein between R and M. Basally it approaches R, but apically it slopes towards M, ending near the furcation of the uppermost median vein. It is questionable whether the branch vein R_5 is retained in this family.

Tanyderidae.—The genus *Radinoderus* has a recurrent stump-vein in the position of the vein V-S, and evidently this is a remnant left at the base of R_5. In Figure 4 the venation is traced from the same reticulation to show the probable homologies.

It would seem that an error was made in regarding the Tabanoidea as having arisen from the Nematocera with a venation like that of the Tanyderidae. These two arose independently from an ancestor with a common reticulate venation.

Remarks and Conclusions.—Theoretically, from the base of V-S to the apex of R_5 the vein is convex, but this is not always apparent throughout, owing to the flattening of the wing in its apical third. Being convex, this vein may be regarded as one unit standing apart from the radial field, and indeed, it may have become quite eliminated in the Cyclorrhapha, except for its traces left in the Syrphidae. If this be so, then the Cyclorrhapha may have only three radial branches, with R_3 and R_4 amalgamated to form the third.

In a letter dated 22nd January, 1947, Dr. C. P. Alexander informed me that Vignon and Séguy (1929) consider the *vena spuria* of the Syrphidae to be the vein MA (anterior median), and it must be noted that the radial sector in this family is reduced to two branches, one obviously compounded with two veins, making three branches detected.

This venational development is too far advanced to make certain of the relationship, but tracing the structure back to the Nemestrinidae with four branches in the radial sector does suggest that in the Syrphidae the *vena spuria* at least incorporates MA.

On the other hand, Tillyard (*Amer. J. Sci.*, ix, 1925, p. 331) remarks: "Thus, it is actually not the posterior median which appears to be missing in recent insects, but the anterior median or convex portion of the media; this . . . is not missing but has

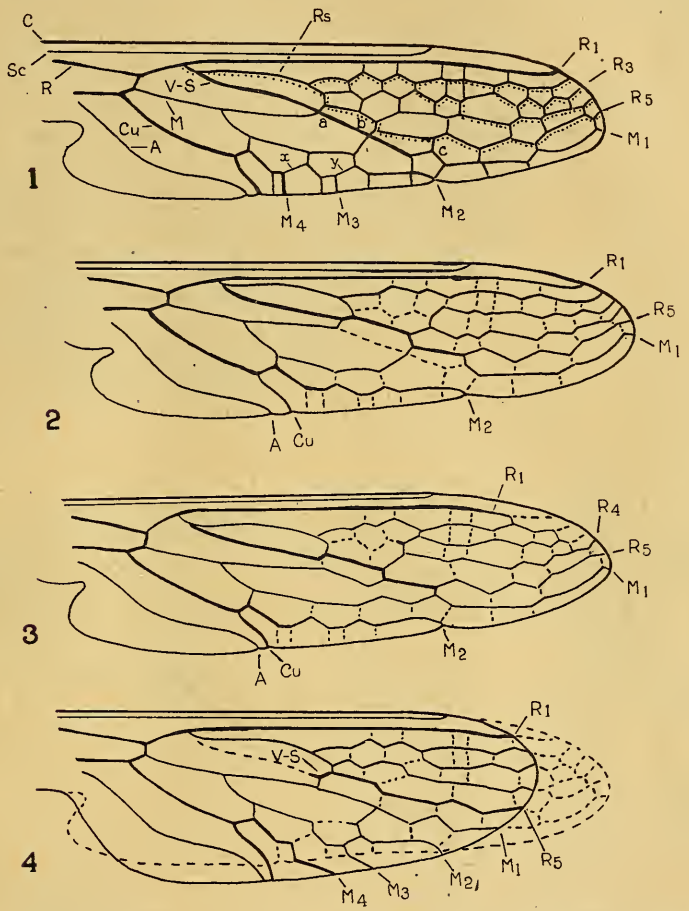

Fig. 1.—A reticulate venation found in *Nemestrinus*. The dots along the veins show those that form a four-branched pectinate radial sector. The convex vein V-S lies between the concave veins R_s and M, this being the position of the convex *vena spuria* in the Syrphidae.

To the Comstock and Needham notation of veins are added here the letters V-S, the homologue of the *vena spuria*: a, b and c, the three radial median cross-veins detected in the Syrphidae; x and y, the two cross-veins sometimes found in the median field.

The dots along the veins denote four branches of the pectinate radial sector which can be developed from this complex venation.

Fig. 2.—The same reticulation retaining the veins corresponding to those of the genus *Trichophthalma*. The vein R_5 is that which bears the notation M_1 in taxonomy.

Fig. 3.—The same reticulation retaining veins corresponding to those of the genus *Diochlistus*. The vein R_1 lies in continuity with cross-veins near the apices of incomplete R_2 and R_3 and complete R_4. This shows a reduction in length of the three upper longitudinal branches, which, in appearance, converge towards the fourth, ending in a common point. R_3 retains a stump-vein.

Fig. 4.—The same reticulation retaining veins corresponding to those of *Radinoderus*. The vein V-S is reduced to a stump, and a cross-vein is inserted between Sc and R_1. The radial sector is dichotomously twice branched in this genus of the Nematocera, a feature that has not been noted in any Brachycera. However, R_5 is always a convex vein and may not belong strictly to the radial sector.

become attached permanently to R_s forming that portion of it which Comstock calls R_{4+5}." Later, Tillyard (Ibid., xi, 1926, p. 135) changed his opinion, stating: "MA, attached to MP in Paleodictyoptera, is attached to R_s in Plectoptera and Odonata, but appears to be entirely missing in most recent orders", and he further specifies its absence in fossil and recent Mecoptera, concluding that it is eliminated throughout the Panorpoid Complex. Had Tillyard seen a fossil wing of a dipteron with the reticulated venation, doubtless he would have placed it in the Plectoptera, on evidence of venation, or else would have proposed a new order for its reception. Tillyard's later view seems to be erroneous.

Conclusions to be drawn at present suggest that:

(*a*). The *vena spuria* in the Syrphidae is a *vena obsoleta*, preserved as a main vein in various families of the Tabanoidea and Asiloidea, but its basal part is lost in the Nematocera.

(*b*). The Brachycera did not evolve its venation from any wing type seen in the Nematocera, but had a separate development from a reticulate venation. Also the Brachycera retains more of the archaic venation than does the Nematocera.

(*c*). Veins do not move from their original course to the extent usually assumed, but instead, different veins survive in the network of the reticulate venation, thus laying down more than one simplified venational foundation within the order.

(*d*). Convexity and concavity of veins are characters assuming greater importance than usually admitted in the study of Diptera. Presumably a convex and a concave vein should not be regarded as homologous in the absence of definite evidence that a change in character has taken place.

References.

Alexander, C. P., 1928.—Proc. Linn. Soc. N.S.W., 53 : 370, figs. 3 and 4 (*Radinoderus*).
Hardy, G. H., 1925.—Ibid., 50 : 141, fig. 1 (*Diochlistus*).
————, 1945.—Ibid., 70 : 142, fig. 1 (*Trichophthalma*).
————, 1946.—Ibid., 71 : 67, fig. 1 (*Panops*).
Macquart, P., 1840.—*Dipt. Exot.*, ii, Pl. 2, fig. 2 (*Nemestrinus*).